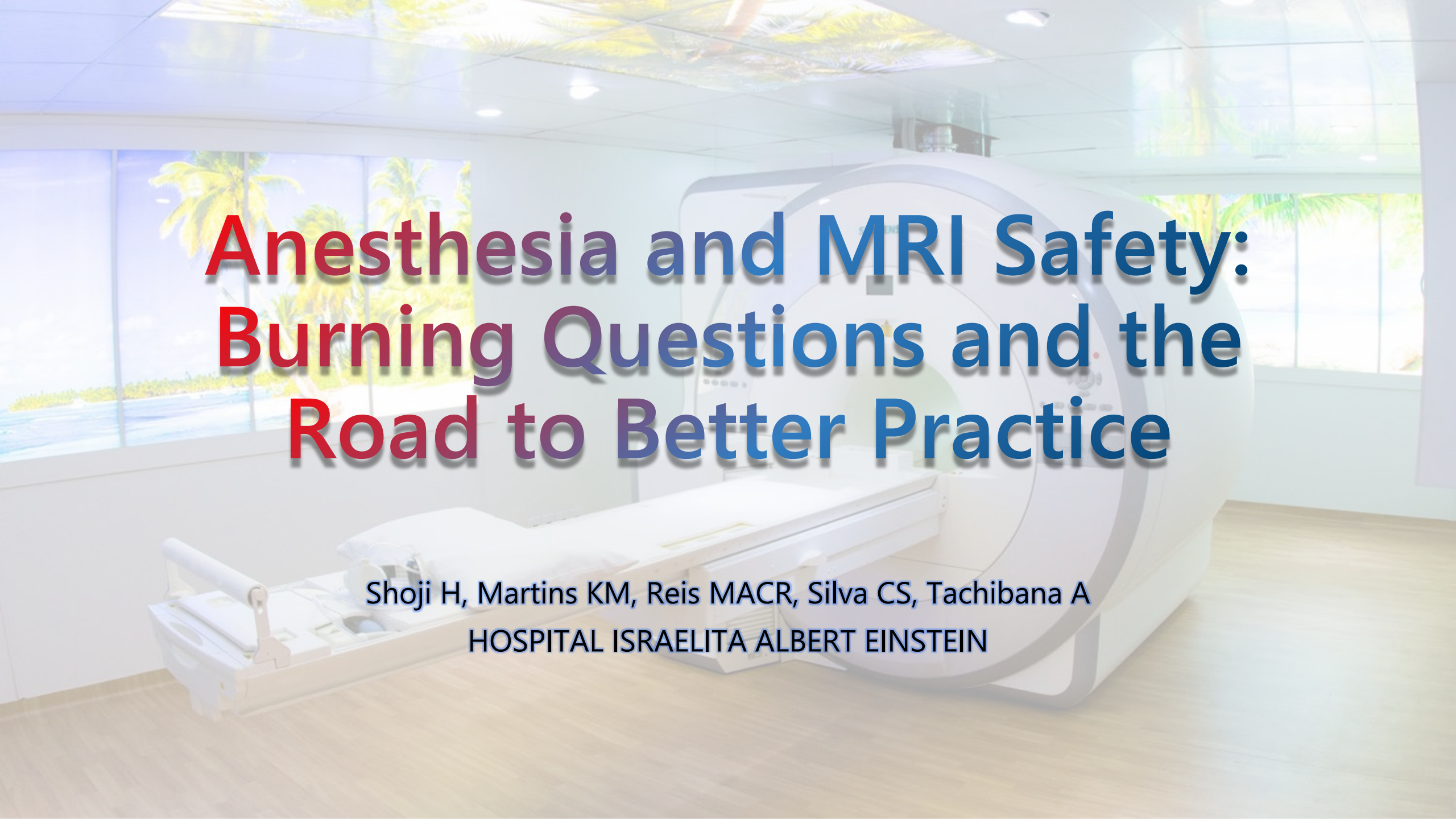


Anesthesia and MRI Safety: Burning Questions and the Road to Better Practice

Shoji H, Martins KM, Reis MACR, Silva CS, Tachibana A

HOSPITAL ISRAELITA ALBERT EINSTEIN

MRI is a staple in medical imaging with unvaluable benefits for precise and timely noninvasive clinical diagnosis, in use for more than 35 years.

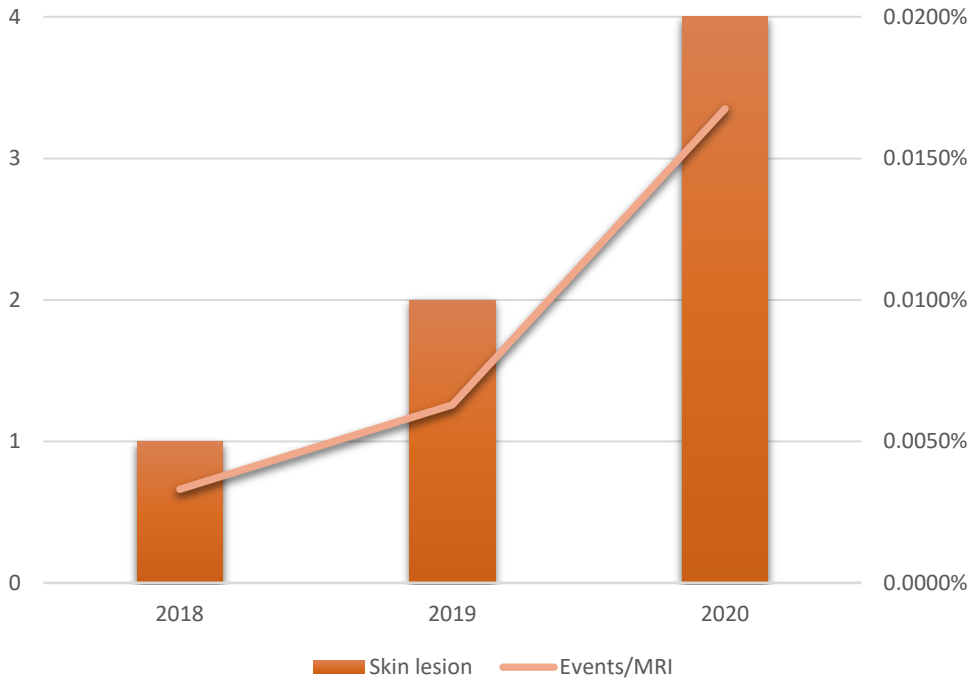
Without the need for ionizing radiation as X-Rays and CTs, it's a very safe imaging modality, but the strong static magnetic fields, pulsed gradient magnetic fields and the radiofrequency energy used to generate clinical images may pose some very specific risks.

In 2019, Delfino et al published a 10-year compilation of US Food and Drug Administration (USFDA) all-purpose MRI-related adverse event reports. Collected data ranged from 1 January 2008 to 31 December 2017, from multiple databases to the USFDA.

Thermal events accounted for 906 of 1548 (59%) of them all.

We report here our ongoing journey to identify and measure risks factors, bring positive change to workflow and culture, and hopefully take adverse events in the MRI environment to zero, particularly those related to burns.

Year-by year MRI-related skin injuries. Rate over total MRI acquired per year.



Pressure ulcer / MRI termal injury

Closed-loop burn

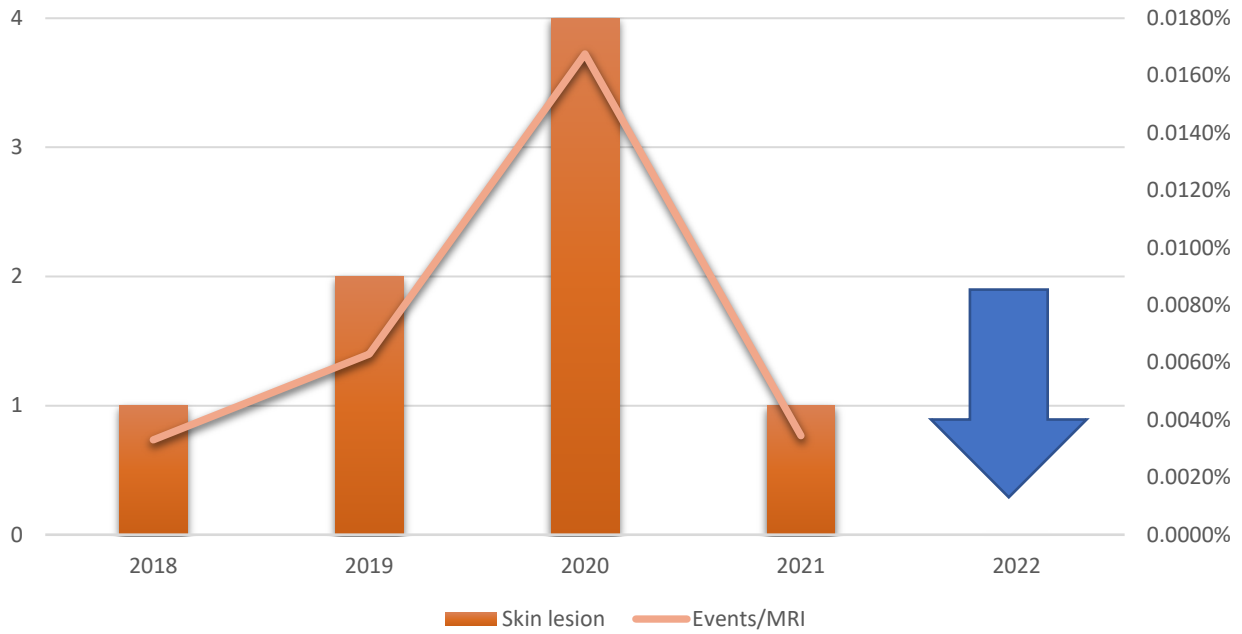
Review of the safety workflow in the MRI room

Capping of MRI acquisition duration

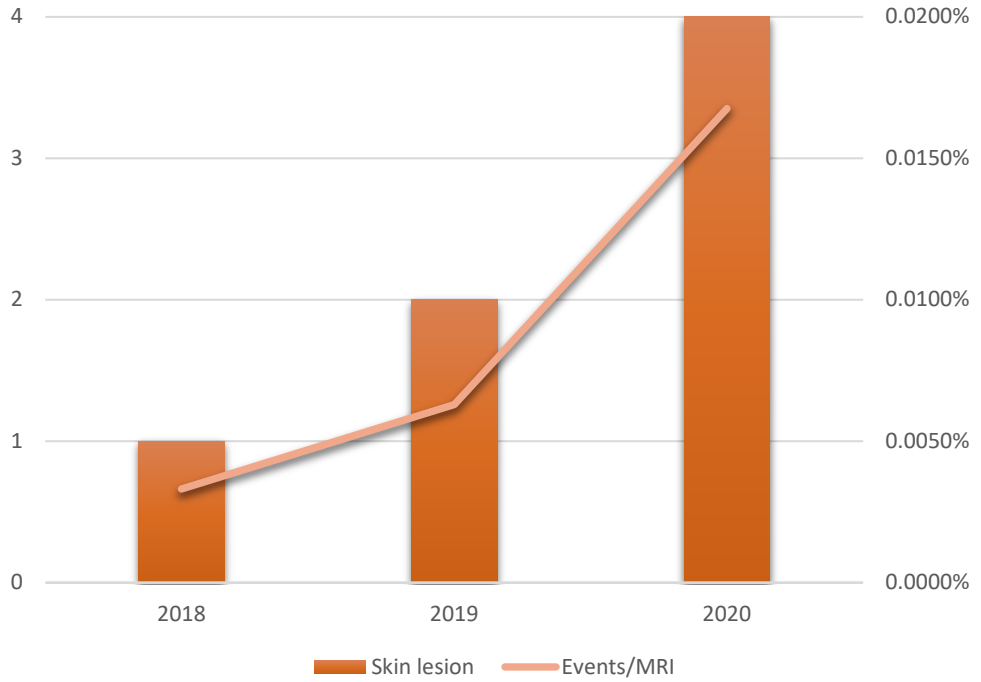
- Limiting of multiples examinations scheduling to 2 hours (typical)
- Breaks after long sequences with restrict observation of SAR/SED limits

Checklist with the correct positioning for all patients submitted to MRI

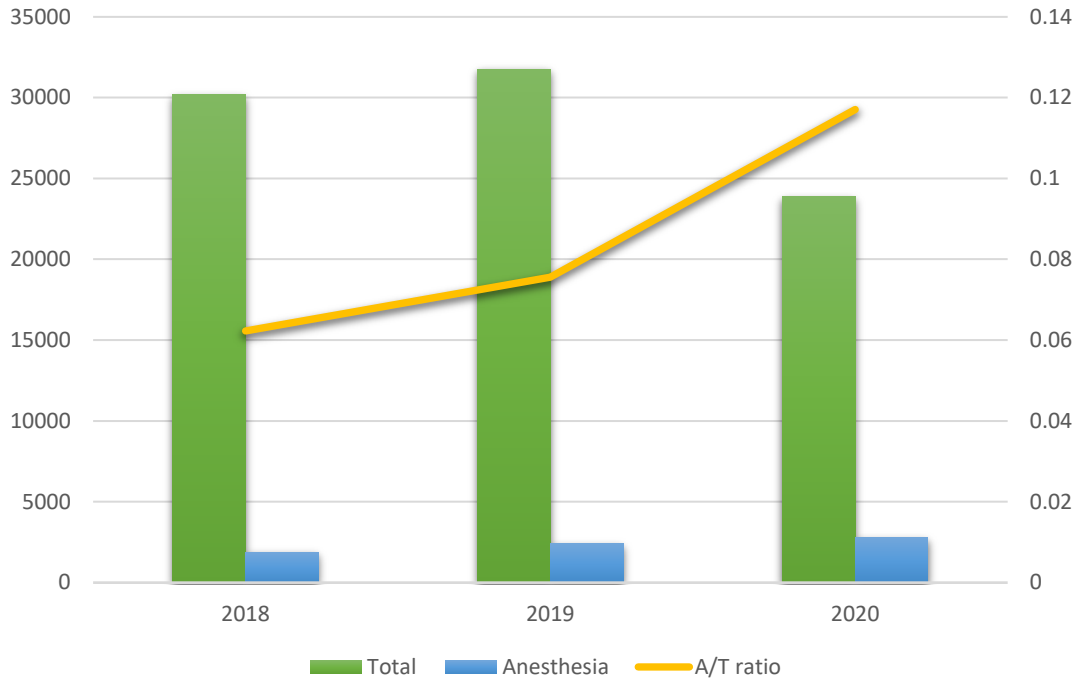
- Padding
- Lines and cables
- Temperature check (multiple sites by hand)



One unprecedent catastrophic event with deep tissue burn and necrosis and posterior amputation



Number of MRI examinations, total and under anesthesia, from 2018 to 2020.



All 9 skin lesions since 2018 occurred on unconscious patients submitted to MRI scans under anesthesia (including the catastrophic event)

Is anesthesia a risk factor for adverse events in the MRI room, particularly for burns?

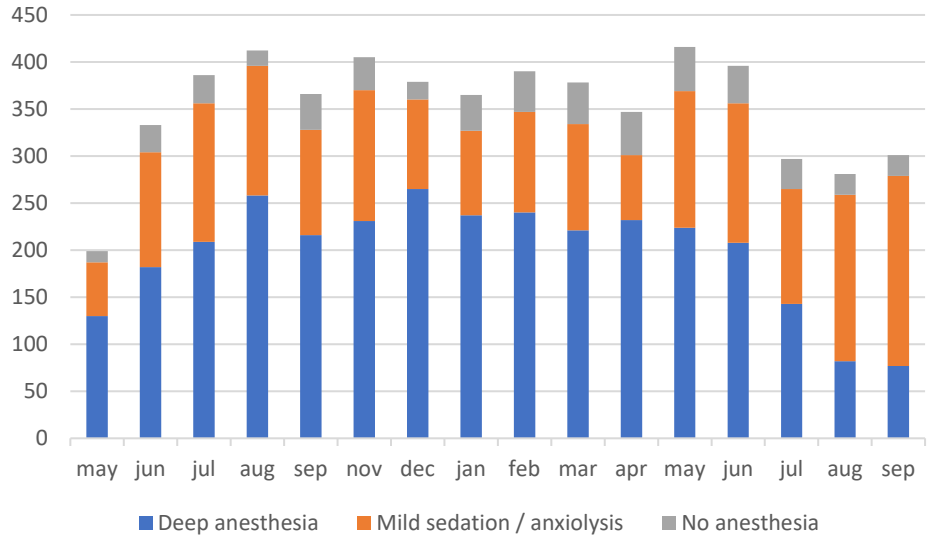
Review of the MRI with anesthetic monitoring workflow

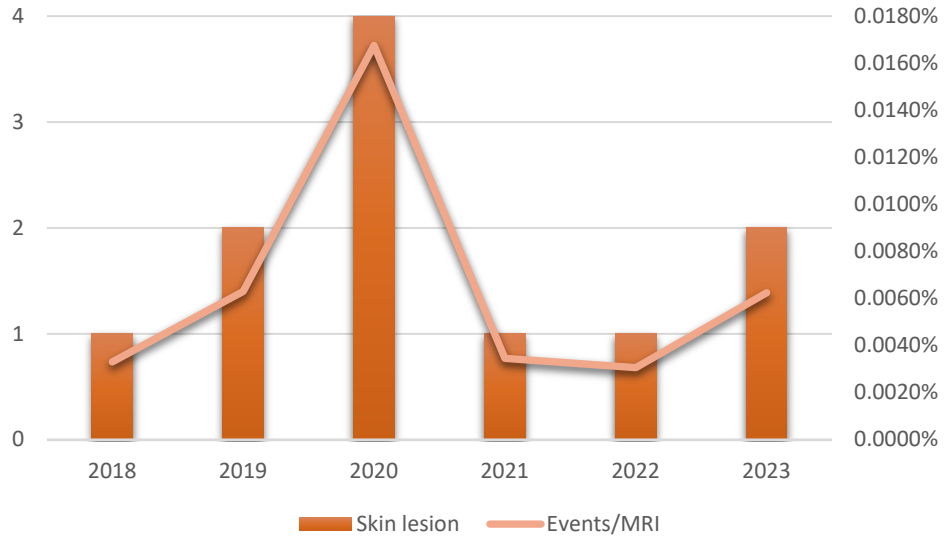
Dedicated radiologists' team to play a central management role of the MRI requested with anesthetic monitoring: discussing the degree of necessity of the examination itself, the restrictions to a non sedated acquisition, alternative diagnostic algorithms; planning a concise protocol to reduce in-machine time; integrating a harmonious MRI facility between patients, techs and anesthesiologists.

Profound cultural changes amongst requesting physicians, radiologists, techs and patients: an aware, collaborating subject may be safer than a deeply sedated, immobile one, incapable of reacting to pain or another alarming signal. MRIs are not completely understood, yet the newer scanners with powerful magnetic fields, gradients and a myriad of radiofrequency patterns; comfort should not surpass safety in a medical facility (or anywhere).

Pivot from deep anesthesia protocols to anxiolysis or mild sedation, unless actual limits to the exam are present (infants or young children, altered mental status, patients uncapable of lying flat).

Number of MRI examinations under deep anesthesia, mild sedation/ anxiolysis and without any level of anesthesia, since May 2022.





Since this change in 2022 we did report 2 very mild thermal burns during MRI (under anesthesia)

Some data, many questions

Although the deeper involvement of the radiologist in the process of scheduling and preparation for MRI patients is in line with a more precise and effective medicine, particularly in today's shift to a fee-for-value paradigm, most services are not suited to the associated costs.

Larger studies are needed to address the hypothesis of anesthesia as a risk factor for thermal burns in the MRI equipment (these are uncommon events).

More experimental studies should help understand energy accumulation and heating patterns amongst different radiofrequency trains, subject positioning, padding and MRI scanners; it should help avoid the specific causes for theses burns.

hamilton.shoji@einstein.br